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Family ownership and R&D investment: The role of growth opportunities and business group membership

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A B S T R A C T

This study examines whether the influence of family ownership on R&D investment varies depending on growth opportunities and business group membership. Using data on Korean firms over ten years (1998-2007), the study shows that family ownership is negatively related to R&D investment, but the relationship becomes positive when growth opportunities are present. The moderating effect, however, differs between independent family firms and family business groups. The positive influence that growth opportunities have on promoting R&D investment is diminished for affiliates of family business groups. These findings imply that family owners invest more in R&D when their family control goals are threatened by the loss of growth potential. The empirical results of this study and its behavioral decision-making model help to bridge the gap between the predictions of the family control perspective and agency theory in explaining R&D investment by family firms in an emerging economy.

Keywords:
R&D investment
Family ownership
Growth opportunities
Business groups
Behavioral decision-making

1. Introduction

Despite the pervasiveness of family firms throughout the world, the implications of family control for value creation through R&D are still not completely clear (Peng & Jiang, 2009). The family control perspective presumes that family owners are primarily interested in maintaining their control of their firms (Gómez-Mejía, Haynes, Núñez-Nickel, Jacobson, & Moyano-Fuentes, 2007), and such goals may conflict with emphasizing R&D investment (Morck & Yeung, 2003). In some cases, family owners may fear that they lack the ability to handle the complex technological problems and organizational/strategic changes that R&D might bring (Gómez-Mejía et al., 2007; König, Kammerlander, & Enders, 2013; Morck & Yeung, 2004). Family control goals are expected to have negative effects on R&D investment in family firms (De Massis, Frattini, & Lichtenthaler, 2013). In contrast, agency theory suggests that although hired managers may act opportunistically by withholding resources from long-term value-creating activities with uncertain outcomes such as R&D (Hoskisson & Hitt, 1988; Latham & Braun, 2009), family owners' incentives are closely aligned with the long-term value of the firm (Jensen & Meckling, 1976).[5] Family owners may thus be expected to favor R&D investment that would help achieve economic goals (Lee & O'Neill, 2003).

These two perspectives have helped to identify the distinct attributes of family owners in R&D investment, but they use a one-size-fits-all approach, creating tension between whether family control goals or economic goals drive family owners' decisions on resource allocation to R&D. In contrast, the behavioral decision-making approach has a more adaptive viewpoint. It suggests that the risk preferences of decision makers greatly depend on their aversion to loss (Wiseman & Gómez-Mejía, 1998). One important consideration that determines whether family owners see themselves as in a loss or a gain position is the gap between aspirations and performance (Cyert & March, 1963). When firms' performance exceeds their aspirations, firms are in gain situations and tend to avoid risky choices, but when it falls short of their aspirations, they are in loss situations and inclined to make risky decisions (Kahneman & Tversky, 1979). This study follows behavioral studies highlighting loss aversions to investigate whether family control

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[5] This managerial agency perspective, suggesting that family owners can reduce agency problems caused by hired managers, differs from the agency problems caused by family members, such as the principal–principal conflicts and nepotism (Schulze et al., 2001), which can contribute to a low R&D investment. This aspect is consistent with the family control perspective.

goals or economic goals motivate family owners' R&D investment decisions (Chrisman & Patel, 2012; Wiseman & Gómez-Mejía, 1998). Among various economic goals, this study treats growth as an important performance goal for family owners as it relates to firm survival, the ultimate family control goal. We conjecture that the loss of growth potential is a threat to family owners' control goals and is largely the basis of loss aversion (cf. Chrisman & Patel, 2012; Greve, 2008; Zellweger, Kellermanns, Chrisman, & Chua, 2012). We test this conjecture by investigating how family owners adjust R&D investment to changes in growth opportunities, as those opportunities have implications for future growth potential when they are exploited by means of R&D (David, Yoshikawa, Chari, & Rasheed, 2006; McGrath & Nerkar, 2004).

Firms operating in industries where growth opportunities are abundant can grow faster than those in adverse environments, but among those firms operating in such favorable environments there are substantial variations in performance/growth depending on their strategic actions (McDougall, Covin, Robinson, & Herron, 1994). We suggest that family firms making insufficient R&D investment become less capable to exploit growth opportunities available in an industry (McGrath & Nerkar, 2004). It represents nonconformity with growing environments (Zajac, Kraatz, & Bresser, 2000), which likely causes problems in actual and relative growth potential in the industry and consequently may become a threat to long-term family control goals particularly if it continues. In contrast, competitors investing in R&D may be in an advantageous position to exploit growth opportunities and as a result grow fast, surpassing those firms less capable to do so. As firms consider peers and competitors when forming their aspirations (Cyert & March, 1963), some firms in growing industries may be in a position of loss if growth opportunities remain unexploited. Therefore, we expect that family ownership encourages R&D investment in the presence of growth opportunities, as family owners who own a larger share of their firms have greater motivation to achieve growth and protect their family control goals. However, the value of R&D in low growth environments tends to be uncertain (Oriani & Sobrero, 2008). In such situations, cutting back on R&D may be a viable strategic choice, as family control goals may be unthreatened.

The relationship between family ownership and R&D investments mentioned above may differ in situations where family control is better protected, such as in affiliates of business groups. Business groups can better protect family control because they can subsidize affiliates (Chang & Hong, 2000; George & Kabir, 2008; Khanna & Rivkin, 2006) and thus contain many affiliated firms that are family controlled. In such contexts, family control and economic goals may severely collide and the convergence of those goals motivated by loss aversion may be delayed. Subsidies by business groups may compensate for the relatively feeble growth potential associated with insufficient R&D in growing industries. In turn, this may limit R&D investments necessary to exploit growth opportunities by individual affiliates.

These ideas can be efficiently tested in the context of South Korea, where ownership and control are highly integrated in family firms, and business groups are prevalent. Therefore, data on publicly listed Korean firms are used to search for influences of family ownership on R&D investment and to uncover how they might differ for family firms belonging to business groups. The findings of this study further clarify the nature of family owners' influence on R&D investment. Unlike the family control and agency theory arguments, our findings suggest that family owners' influence on innovation investment varies depending on the presence of growth opportunities, and that business group membership is an important boundary condition for the relationship. These findings imply that family owners behave like value-conscious owners when their control goals are threatened due to the potential loss of economic goals such as firm growth.

2. Theoretical background and hypotheses

2.1. Family owners and R&D investment

Research on family business[6] demonstrates that family owners who control a firm's management are salient in both developed and developing countries where corporate control by the markets is weak (Aguilera & Jackson, 2003; La Porta, Lopez-de-Silanes, & Shleifer, 1999). They often install a family member as CEO or in another senior management position (Villalonga & Amit, 2006). These family owners have non-financial motives, such as a need for belonging, preservation of family wealth, dynastic continuity, and family social status (Gómez-Mejía et al., 2007; Zellweger & Astrachan, 2008). Preserving family control of the firm is usually the primary goal among their non-financial values, as only in this way can the family continue to pursue its interests through the firm (Kim & Gao, 2013; Zellweger et al., 2012).

Family owners may be tempted to discourage R&D investments to emphasize family control goals. Often this occurs because they do not feel well equipped to deal with complex technology issues (Morck & Yeung, 2004). If so, they may find it desirable to limit the firm to applying technologies that family members themselves can understand. Beyond that, successful R&D often requires new arrangements and new routines. Such changes and experiments may be perceived as a threat to a family's control of their firm. Instead, family owners may prefer to emphasize alternative ways to maintain and expand their businesses, such as political lobbying (Morck & Yeung, 2003). Investment aversion may also arise from long-standing relationships that ensure the selection of officers who are beholden to the family or to a particular group closely related to the family owners (Schulze, Lubatkin, Dino, & Buchholtz, 2001). The majority of empirical studies (De Massis et al., 2013) investigating the relationship between family ownership and R&D investment report a negative relationship between the two in Canada (Morck, Stangeland, & Yeung, 2000; Muñoz-Bullón & Sanchez-Bueno, 2011), Europe (Munari, Oriani, & Sobrero, 2010; Sirmon, Arregle, Hitt, & Webb, 2008), Taiwan (Chen & Hsu, 2009), and the U.S. (Block, 2012).

At the same time, agency theorists predict that management by a controlling shareholder should often correlate with greater firm value because the owners' interests are well aligned with increasing the value of the firm. Such shareholders can alleviate the agency problems involved with hired managers and encourage the pursuit of long-term investments, such as R&D (Berle & Means, 1932; Berrone, Surroca, & Tribo, 2007; Jensen & Meckling, 1976). These are sensible arguments, but little empirical evidence supports the prediction that family firms should favor investment in innovation as a means of promoting long-term survival and growth. Instead, a few studies suggest that family owners promote R&D investment only under certain conditions. For example, Chrisman and Patel (2012) investigate manufacturing firms in the U.S. and report that the influence of family owners on R&D varies depending on the gap between aspiration and performance.

2.2. Growth opportunities and family owners' influence on R&D investment

Decision makers in behavioral studies are postulated to change their risk preferences depending on their loss or gain position, which is influenced by the gap between aspirations and performance (Cyert & March, 1963; Greve, 2003). Prior research extensively examined this behavioral decision-making thesis in a variety of settings, such as R&D investment and financial markets (Baum, Rowley, Shipilov, & Chuang, 2005; Greve, 2003). By applying this logic, this study focuses (among various performance facets) on growth, as it is a dominant performance goal for family owners (Grossman, 1993; Kim & Gao, 2013; Zellweger et al., 2012).

[6] As this study focused on family firms, "independent firms" refers to family firms that are not members of any business group, and "business groups" refers to family business groups.

Growth is essential for firm survival, a prerequisite for family owners' long-term control goals (cf. Greve, 2008). In industrial economics and organizational ecology studies, it is an established fact that a firm's survival likelihood increases with its size and age (Audretsch, 1995; Jovanovic, 1982). However, as the effect of these factors (especially initial size) decreases over time, a firm's growth rate becomes more important in shaping its chances of survival (Agarwal, 1997; Mata, Portugal, & Guimaraes, 1995). Hence, enhancing growth potential is conducive to survival and thus consistent with family owners' interest in long-term control goals (cf. Chrisman & Patel, 2012; Greve, 2008; Zellweger et al., 2012), indicating that family owners' influence on R&D investment may rely on their judgment of the loss of growth potential.

In an effort to examine this relationship, we focus on how family owners adjust their influence on R&D investment according to growth opportunities. In growing industries, firms are likely to be performing well and growing faster than when they would operate in adverse environments. However, even in such favorable environments, firms' performance significantly varies depending on their strategic actions. Growing business environments generally involve technological changes and favor an aggressive strategic posture (McDougall et al., 1994), such as R&D and product development activities (Audretsch, 2004; Covin & Slevin, 1988; Del Monte & Papagni, 2003). Similarly, many empirical studies support the view that growth opportunities are call options whose values depend on the discretionary investments made by a firm (David et al., 2006; Wright, Ferris, Sarin, & Awasthi, 1996). For example, McGrath and Nerkar (2004) show that investment in R&D helps exploit opportunities resulting from industry growth and as a result can have greater upside than downside potential. Further, R&D investments by firms with promising growth opportunities lead to an increase in market valuation (Szewczyk, Tsetsekos, & Zantout, 1996). As R&D investment implies a firm's capacity to exploit growth opportunities (Cohen & Levinthal, 1990; McGrath & Nerkar, 2004), we posit that reducing R&D investment in growing environments represents misfit and makes firms less capable to exploit growth opportunities available in the industry.

The relationship described above suggests that firms should adjust their investments to fit the business environment. Misfit has a detrimental performance effect, threatening firm survival in the long run. Zajac et al. (2000) empirically show that in the U.S., savings and loans industry organizations that deviated from the predicted strategic fit experienced significant negative performance consequences. Other studies report that firms exhibiting misfit between their strategies and environments generate lower returns on assets than those firms with better fit (Burton, Lauridsen, & Obel, 2002). Insufficient R&D investment in a growing industry is a prime example of misfit that can lead to limited growth potential and greater risk of failure, particularly if growth continues to be restrained (McDougall et al., 1994). The threat to maintaining family owners' long-term control goals is particularly severe when competitors are growing faster than the focal family firms as a result of aligning their innovation activities with the growing industry's requirements. A widening gap in growth potential in comparison with industry competitors strongly implies a decline in the market power of family firms in future competition (Cool & Dierickx, 1993). Hence, firms in growing industries may still need R&D investment to exploit any available growth opportunities so as to keep up with not only their own internal expectations, but also those of their industry competitors (Baum et al., 2005; Cyert & March, 1963). As suggested above, if family firms make insufficient R&D investment in growing industries and thus lag behind their competitors, they might find themselves in a position of loss rather than of gain with respect to growth potential and long-term family control goals. The behavioral decision-making approach predicts that this situation encourages family control goals and economic goals to converge, increasing R&D investment (cf. Chrisman & Patel, 2012; Wiseman & Gómez-Mejía, 1998). Greve (2008) shows that when firms are below the aspiration level for size, they attempt to grow more.

The discussion presented so far indicates that family owners may make investments in R&D when facing growth opportunities; otherwise, they may experience loss in both growth potential and long-term family control goals. This inclination is greater for family owners who hold larger shares, as they might be more interested in preserving family control from threats caused by limited growth potential. However, in low-growth environments there is no strong evidence for a positive relationship between R&D and growth potential. R&D in such environments may take more time to bear fruit and entail greater risks. Hence, R&D investment may be not an efficient approach to finding a better fit in low-growth environments, in which family owners are unlikely to find themselves in a loss position and would discourage R&D investment. This is particularly true for family owners who own a large share of their firms. Thus,

Hypothesis 1. Industry growth opportunities moderate the relationship between family ownership and R&D investment in a way that the relationship becomes positive.

2.3. Business group membership and the effect of growth opportunities on R&D investment

The idea that limited growth potential damages family owners' ability to maintain family control goals and likely puts them in a loss position may depend on the condition that influences the extent to which family control is protected. One such condition is the business group organizational form. As family control is well protected in business groups, the growth problems caused by inadequate R&D investment may give little threat to the family owners of business groups.

A business group is a set of legally independent companies (affiliates) that are governed by the same controlling owner. Family owners are often inclined to form a business group to reduce firm-specific risks (Amihud & Lev, 1981). They seek to create internal factor markets, which they hope will be more efficient than external markets, particularly in less-developed economies where external product, financial, and labor markets remain immature (Cuervo-Cazurra, 2006; Khanna & Palepu, 2000). In many emerging economies, such as in Korea, controlling owners exercise almost full control over all of the affiliated firms through extensive ownership and other ties among the affiliates (Joh, 2003; Kim, Hoskisson, Tihanyi, & Hong, 2004). Business groups are also often involved with the investment decisions and resource allocations of each affiliate (Cuervo-Cazurra, 2006; Khanna & Palepu, 2000; Kim et al., 2004; Rajan, Servaes, & Zingales, 2000).

As family owners create or acquire more affiliates, forming a larger business group, they are more likely to view the arrangement as favorable for their family control goals. The literature on business groups suggests that family control goals are better protected in the business group structure than in the independent firm structure. In business groups, family control is usually strengthened through pyramidal and/or cross-shareholding ownership structures, which use indirect ownership to exert control over the firms belonging to the group (Almeida, Park, Subrahmanyam, & Wolfenzon, 2011). Prior studies also suggest that business groups focus primarily on stable performance, believing it conducive to group survival. For example, failure of an affiliate could have a serious detrimental effect on the reputation, survival, and consequently family control of the entire group (Ferris, Kim, & Kitsabunnarat, 2003). Hence, business groups tend to support troubled affiliates by moving funds from other strong affiliates. This substantially reduces the loss of family control goals, which is supposedly motivated by business failure, compared to when they were an independent firm. Thus, business groups often engage in cross-subsidization to help unprofitable affiliates (Bae, Kang, & Kim, 2002; Ferris et al., 2003; George & Kabir, 2008; Whited, 2001) by, for example, providing loans or loan guarantees, through equity investment, and through internal transactions (Estrin, Poukliakova, & Shapiro, 2009; Friedman, Johnson, & Mitton, 2003).

In Hypothesis 1, we argue that neglecting R&D in a growing industry will raise a family owner's concern about future growth potential vis-à-vis their competitors, i.e., threats to family control, which put family owners in a position of loss rather than of gain. However, any such relationship will be weaker in the family business group context. The negative consequence of restraining R&D investment may be less severe and more easily mitigated in business groups than in independent firms. In business group structures, insufficient R&D in an affiliate is less likely to threaten family owners in business groups, failing to prompt family owners to invest in R&D when the industry offers growth opportunities. Thus,

Hypothesis 2. Business group affiliation moderates the joint effect of industry growth opportunities and family ownership on R&D investment in a way that the joint effect becomes negative.

3. Methods

3.1. Sample

South Korea provides an ideal context for testing these hypotheses because family owners are so prevalent (Nam, 2004) and well-known to strongly influence their firms' business decisions (Jang & Kim, 2002; Solomon, Solomon, & Park, 2002). This study focuses on family controlled manufacturing companies that were listed on the Korea Stock Exchange from 1998 to 2007. Family controlled firms are those in which ownership and management are concentrated within a family unit (Arregle, Hitt, Sirmon, & Very, 2007; Litz, 1995), specifically where the controlling shareholder and/or his or her family, by either blood or marriage, hold 5% or more of the firm's equity and at least one of them is the CEO, president, chairman, vice-president, or a registered board member (cf. Claessens, Djankov, & Lang, 2000; Villalonga & Amit, 2006). The controlling shareholder of a firm in Korea is defined in Korea's Securities and Exchange Act as a person or entity that owns or controls the firm. He or she is usually the largest shareholder. After eliminating observations with incomplete information about R&D spending, this classification yielded 2136 firm-year observations (an unbalanced panel; 298 firms). The data were collected from the Korea Investors Service database, which contains company profiles, ownership information, and financial data for all publicly listed Korean firms.

3.2. Measures

The dependent variable, *R&D intensity*, was measured annually as the ratio of a firm's R&D expenditure to its total sales (David et al., 2006).

Consistent with prior studies (Chang, 2003), *family ownership* was quantified as the ratio of the common shares of a family firm held by the largest shareholder and other entities having a special relationship with the shareholder, which usually included family members and affiliated firms (Bae et al., 2002; Chang, 2003). Affiliates' ownership was included in family ownership, as affiliates in the Korean context are owned and controlled by the business group's family and thus similar to divisions in diversified corporations (Chang, 2003; Chang & Choi, 1988).

Growth opportunity was calculated as the average three-year annual growth rate of sales in each industry defined at the two-digit SIC level, which was assumed to reflect the growth trajectory of the industry in which a firm participated. Industry growth rate is widely used as an indicator of market attractiveness (Datta, Guthrie, & Wright, 2005; Hambrick & Abrahamson, 1995; McDougall et al., 1994; Wernerfelt & Montgomery, 1986).

Business group affiliation was represented by a dummy variable with the value of one, if the firm was a member of one of the large business groups identified in the Korean Fair Trade Commission's (KFTC's) annual listing, and zero otherwise (Chang & Hong, 2000). The KFTC defines a business group as a set of companies that are governed by the same shareholder or a company that is affiliated with the shareholder in terms of ownership (more than 30%) or actual control (e.g., the ability to unilaterally select the CEO). The number of business groups listed changed over the sampling period because the Korean government revised its policy on business groups during that period. Before 2002, large business groups were selected based on the total asset size, but afterwards regulation was applied based on specific policy purposes, such as limiting cross-shareholding and total shareholding, and different asset sizes were applied. Despite these policy changes, the list of large business groups was built around the 30 largest groups. Using a dummy variable to represent business group affiliation is consistent with the methods of previous studies (Chang, Chung, & Mahmood, 2006), but it did not capture the fact that many independent firms also establish a small group of affiliates. The arguments about large business groups may also be applicable to such small groups. To check robustness, the *number of total affiliates* for each sample firm in each year was collected from each firm's annual report and included in the analysis.

The analyses also incorporated several control variables related to firm-specific factors that could influence R&D intensity. *Firm size* was represented by the logarithm of each firm's total sales in each year. *Firm age* was calculated as the difference between the current year and the founding year reported by the firm. The log value of firm age was used in the analyses. The availability of cash resources was measured by *operating cash flow*, defined as the cash flow generated from operating activities, after deducting interest and taxes (but before cash dividends), divided by each year's total sales. A firm's *return on assets* was also included, measured as net income divided by total assets. The *debt ratio* was measured as total debts divided by total assets. *Year dummies* and *industry dummies* were also included to control any year-specific and industry-specific effects.

3.3. Analysis

Ordinary least squares (OLS) may provide biased estimates for such panel data because of unobservable heterogeneity in firm characteristics. Fixed-effects estimation addresses unobserved firm heterogeneity as long as the errors are independent and homoscedastic. However, these conditions are rarely met in panel data (Davidson & MacKinnon, 1993). To deal with these difficulties, generalized estimating equations (GEEs) were evaluated to test the hypotheses. This method accounts for any within-subject correlations, avoiding spurious results arising from first-order autoregressive correlations (Ahuja & Katila, 2001; Liang & Zeger, 1986). Furthermore, GEE models are known to provide robust variance estimates that account for heteroscedasticity and unobserved differences among firms (Henderson, Miller, & Hambrick, 2006). OLS and fixed-effects estimation methods were also used in the robustness checks. Endogeneity in the relationship between family ownership and R&D investment is a great concern. We have made several efforts to alleviate this concern. For example, a lagged dependent variable was maintained as a control variable. The *growth opportunity* variable defined in this study is rather exogenous, as it reflects the average sales growth of industries rather than individual firms' capabilities. Further, family ownership and R&D investment may be influenced by a third omitted variable. To account for this concern, the dynamic panel generalized method of moments (GMM) estimation was performed. This method is known to address the concern of biases due to potential omitted variables (Arellano & Bond, 1991; Greene, 2003).

4. Results

Descriptive statistics and a correlation matrix describing the data are presented in Table 1. Although most of the correlation coefficients are low, the dependent variable and its lagged version are closely

Table 1
Descriptive statistics and correlations.

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1. R&D intensity	0.010	0.023	1.000									
2. R&D intensity (t − 1)	0.010	0.022	0.784	1.000								
3. Firm size (log)	0.119	0.012	0.003	0.002	1.000							
4. Firm age (log)	3.556	0.350	−0.066	−0.099	0.252	1.000						
5. Operating cash flow	0.059	0.105	0.008	−0.057	0.149	−0.022	1.000					
6. ROA	0.031	0.081	0.041	0.034	0.139	−0.054	0.371	1.000				
7. Debt ratio	0.439	0.194	−0.110	−0.100	0.114	−0.010	−0.251	−0.437	1.000			
8. Business group affiliation	0.134	0.341	0.004	0.005	0.644	0.200	0.075	0.051	0.084	1.000		
9. Growth opportunity[a]	0.157	0.132	0.191	0.148	−0.102	−0.211	0.028	0.007	−0.037	−0.090	1.000	
10. Family ownership[a]	0.343	0.182	−0.137	−0.104	0.045	0.060	0.080	0.134	−0.178	0.093	−0.210	1.000
11. Total affiliates[a]	7.943	8.585	0.045	0.041	0.585	0.153	0.086	0.041	0.037	0.663	−0.030	0.061

Correlation coefficients greater than 0.045 are significant at the $p \leq 0.05$ level of confidence (two-tailed).
[a] These variables were used in interaction terms and were centered in the analysis to reduce potential multicollinearity.

correlated, as are firm size and business group affiliation/total affiliates. To reduce the potential effect of these high correlations on the estimates, the variables were mean-centered before creating the interaction terms, which reduced the correlations substantially. The impact of collinearity was investigated using a variance inflation factor (VIF) for each variable in the OLS regressions corresponding to the estimation models appearing in Table 2. All of the variables, including the three-way interactions, show acceptable VIFs. For example, in Model 6 (OLS) of Table 2, the mean VIF value of the variables is 1.67, ranging from 1.09 to 2.39. Further, the highly correlated total affiliates and business group membership variables are not entered in the same regression equation. Thus, multicollinearity is not a serious problem in the analyses.

Table 2 presents the coefficients of the estimations. Model 1 examines the effects of the control variables. The results show that R&D

Table 2
Coefficients of the estimations predicting R&D intensity.[a,b].

Dependent variable: R&D intensity	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	GEE					OLS	Fixed effects	Dynamic GMM
Constant	0.014*	0.015**	0.019***	0.019***	0.011*	0.012**	0.029	
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.024)	
R&D intensity (t − 1)	0.352***	0.355***	0.359***	0.361***	0.687***	0.509***	0.179***	0.146***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.017)	(0.012)	(0.015)	(0.034)
Firm size (log)	0.098**	0.091*	0.051	0.045	0.066†	0.022	0.075	−0.444
	(0.039)	(0.038)	(0.039)	(0.038)	(0.035)	(0.028)	(0.083)	(0.810)
Firm age (log)	−0.004***	−0.004***	−0.004***	−0.004***	−0.004***	−0.002**	−0.008	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)	(0.002)
Operating cash flow	−0.003	−0.003	−0.003	−0.003	0.002	−0.008**	0.000	0.039***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.008)
ROA	0.000	0.000	0.000	−0.001	0.004	0.001	0.000	−0.129***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.018)
Debt ratio	−0.006**	−0.006***	−0.006***	−0.006**	−0.003	−0.005***	−0.003	−0.122***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.020)
Business group (BG)	0.002	0.002	0.004**	0.004**		0.004***	0.003	−0.054
	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.003)	(0.045)
Family ownership (FO)	−0.003†	−0.002	0.000	0.000	0.002	0.001	−0.001	−0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.011)
Growth opportunity (GO)	0.010**	0.011***	0.011**	0.011**	0.010*	0.008*	0.007**	0.082***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.017)
FO * GO [Hypothesis 1]		0.042***	0.039***	0.049***	0.052***	0.048***	0.027**	0.555***
		(0.011)	(0.011)	(0.012)	(0.016)	(0.011)	(0.011)	(0.098)
FO * BG			−0.016***	−0.022***		−0.019***	−0.007	0.060
			(0.005)	(0.005)		(0.004)	(0.006)	(0.066)
GO * BG			0.013	0.012		0.021**	0.006	−0.034
			(0.009)	(0.008)		(0.007)	(0.008)	(0.073)
FO * GO * BG [Hypothesis 2]				−0.126**		−0.108***	−0.087*	−0.804**
				(0.041)		(0.034)	(0.039)	(0.295)
Total affiliates					0.000			
					(0.001)			
FO * total affiliates					−0.005*			
					(0.002)			
GO * total affiliates					−0.003			
					(0.004)			
FO * GO * total affiliates					−0.052**			
					(0.019)			
Industry dummies	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	
Year dummies	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Wald's Chi-squared (F)	1560***	1628***	1725***	1789***	3212***	85.75***	8.97***	4322***
Firm-years	2136	2136	2136	2136	1997	2155	2136	2181
Groups	298	298	298	298	281		298	318

† Indicates significance at the $p \leq 0.10$ (*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$) level of confidence (two-tailed); Standard deviations are given in parentheses.
[a] All of the variables entered on the right-hand side of each equation have a one-year time lag, except for the year and industry dummies.
[b] The continuous variables entered into the interaction terms were centered to reduce potential multicollinearity.

intensity is autocorrelated and also correlated with debt, family ownership, and growth opportunity. Hypothesis 1 suggests that growth opportunity and family ownership are jointly related to R&D intensity. In Model 2, the estimated coefficient of the interaction term is significant and positive (0.042, $p \leq 0.001$). This result strongly supports Hypothesis 1.

Hypothesis 2 posits that the interaction between family ownership and growth opportunity is negatively moderated by business group affiliation. The three-way interaction model, Model 4, tests this hypothesis. The coefficient of the family ownership and growth opportunity interaction term is significant and positive in Models 2 and 3, but the coefficient of the three-way interaction relating family ownership, growth opportunity, and business group affiliation is negative (-0.126, $p \leq 0.01$) in Model 4. These results suggest that family owners promote R&D in the presence of growth opportunity significantly more in independent family firms than in business group affiliates. Hypothesis 2 is thus supported. Overall, the models explain a significant proportion of the variance in R&D intensity. The adjusted R^2 for Model 6 (OLS) is 0.63, which explains more than half of the variance in R&D intensity of the sample firms.

To better understand the specific moderating effects, interaction plots were prepared using the procedure recommended by Cohen and Cohen (1983). One standard deviation below and above the mean was taken as the range for the variables in the interaction terms, and the other variables were held at their mean values. Fig. 1 shows that the positive joint relationship of family ownership and growth opportunity with R&D intensity is much stronger when family ownership is high than when it is low, which supports Hypothesis 1.

Hypothesis 2 proposes that the relationship between family ownership, growth opportunity, and R&D intensity depicted in Fig. 1 should be weaker for business group affiliates. Fig. 2 shows that for independent firms, the patterns (lines 2 and 4) of the relationship are the same as in Fig. 1. However, lines 1 and 3 in Fig. 2 demonstrate that the joint influence of family ownership and growth opportunity on R&D intensity is negative in business group affiliates, and it becomes even more negative when the proportion of family ownership is greater. These negative relationships between family ownership, growth opportunity, and R&D investment are consistent with the idea that business group owners may not perceive threats from cutting back on R&D when there are growth opportunities. Thus, the relationships depicted in Fig. 2 support Hypothesis 2.

The results appear to be insensitive to the alternative measures, to additional control variables, and to the estimation method used. Model 5 uses the number of affiliates instead of the dichotomous dummy variable of business group affiliation, showing that as the number of a firm's affiliate increases, the positive interaction effect of family

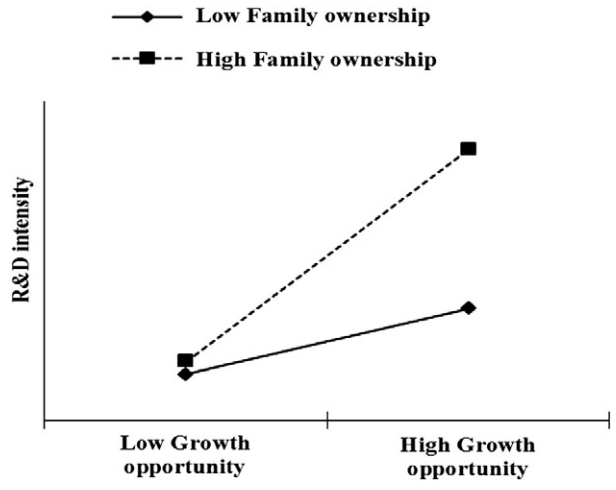

Fig. 1. Interaction of family ownership with growth opportunity and R&D intensity.

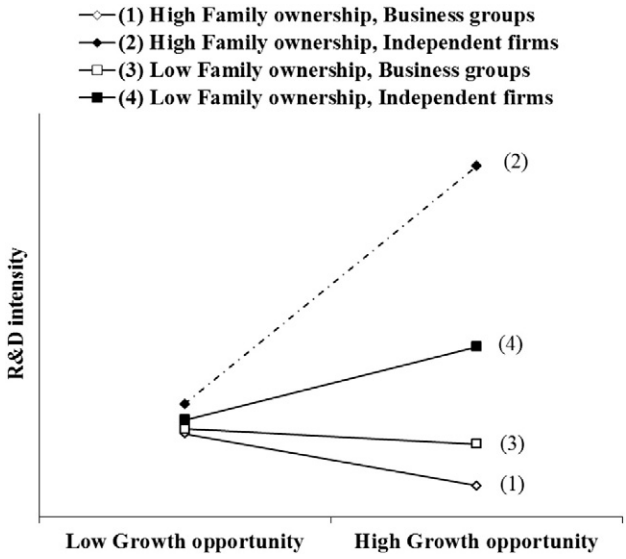

Fig. 2. Interaction of family ownership, growth opportunity, business group affiliation, and R&D intensity.

ownership and growth opportunity is attenuated. In Model 5, the coefficient of the term representing the interaction of family ownership and growth opportunity is positive and significant (0.052, $p \leq 0.001$), but it becomes negative (-0.052, $p \leq 0.01$) as the number of total affiliates increases. Further, the OLS (Model 6), fixed-effects (Model 7), and dynamic GMM (Model 8) estimations all return consistent results. Analyses with additional control variables such as capital investment, a dummy variable indicating the policy change in 2002, other affiliates' average R&D intensity, and analysis using alternative measures of family ownership (raising the ownership portion of the family from 5% to 10% and 15% of the total shares) all returned results that concur with Model 4 in Table 2. These results are not shown, but are available from the authors on request.

5. Discussion

Debate persists about the effect of family ownership on firms' R&D investment. The results of this study using data from publicly listed Korean corporations suggest that the influence of family ownership on R&D investment is positively moderated by growth opportunities, but this relationship is not the same in all firms. That is, the influence of family owners exploiting growth opportunities through R&D investment is weaker in large family business groups where family control is more secure.

By approaching the issue from a behavioral decision-making perspective, this study argues that neither the family control perspective nor agency theory alone can effectively explain the influence of family ownership on R&D investment. Focusing on the deterministic view of these perspectives is likely to fail to adequately capture the subtleties of the effect of family ownership on innovation in firms facing different levels of industry growth and different organizational environments, such as business group affiliation. The results of this study help to bridge the gap between the predictions of the family control perspective and agency theory, at least for the firms studied. Chrisman and Patel (2012) showed that family firms promote R&D investment more than nonfamily firms when their firms' performance is below aspirations. Our results obtained by investigating R&D investment within family firms supplement theirs by highlighting that firms with a high proportion of family ownership promote R&D when external growth opportunities are perceived. The results support the loss aversion perspective with respect to family firms (Chua, Chrisman, & Sharma, 1999; James, 1999; Zellweger & Nason, 2008). Our results are particularly useful

because they point out that family influence on firm innovation may be balanced by family owners' concerns about the loss of family control due to potential growth problems and eventual threats to firm survival. The research model used in this study offers a dynamic view that helps explain family owners' preferences in different contexts based on loss aversion and is more amenable to the pursuit of growth (Greve, 2008).

This study also helps to explain the effect of the frequently observed behavior of family owners in the context of business groups. The results indicate that family control goals converge with economic goals less often for firms in family business groups. This finding is particularly interesting because it is not explained by prior studies that highlight other attributes of business group affiliation. For example, published research reports that more diversified firms have an appropriability advantage in their technological efforts (Argyres & Silverman, 2004). Business group affiliates may gain similar benefits from group membership because they can obtain more complementary resources from and achieve synergy with their affiliates (Chang & Hong, 2000; Chang et al., 2006; Khanna & Rivkin, 2001). These advantages of business groups, particularly their ability to share technical knowledge and financial resources with their affiliates, helped business group affiliates outperform independent firms in Korea during the early 1990s in terms of patents filed (Chang et al., 2006). This logic predicts that the controlling shareholders of business groups should invest more in R&D than those of independent firms because they anticipate better returns. However, this study shows that the positive interaction of family ownership and growth opportunity with R&D investment can be significantly attenuated in family business groups. Despite growth opportunities, family owners may not view business groups' underinvestment in R&D as a loss position because their control goal is not strongly dependent on the performance of individual affiliates. This behavioral explanation clarifies why family owners belonging to business groups may appear insensitive to growth opportunities in contrast to the owners of independent family firms.

The results underscore the need to address principal–principal conflict problems in business groups (Hambrick, Werder, & Zajac, 2008). For example, Brush and his colleagues show that managers of family owned businesses search more diligently for growth opportunities and strive to achieve the best possible performance with internal capital (Brush, Bromiley, & Hendrickx, 2000). However, this behavior may not hold in business group affiliates (particularly in the case of internal growth through R&D), as our results indicate that family owners belonging to family-controlled business groups may not be strongly influenced by growth opportunities when making discretionary R&D investments. This pattern of investment behavior in business groups may also occur with respect to the use of financial slack. Kim and his colleagues show that family ownership positively moderates the relationship between financial slack and R&D investment in Korean firms (Kim, Kim, & Lee, 2008), but this effect may be weakened when business group affiliation is considered.

The findings of this study may have implications for the positive relationship postulated in agency theory between insider ownership and R&D investment/risk taking (Amihud & Lev, 1981; Hill & Snell, 1988; Johnson, Hoskisson, & Hitt, 1993). Although the traditional view of agency theory suggests a positive influence of insider ownership on risk taking, some studies focusing on the insiders' wealth concentration suggest that an increase in insider ownership may lead to a negative effect on risk taking. They argue that if a significant portion of an insider's wealth is concentrated in a single company (as is the case with insiders holding substantial equity), the insider may find it undesirable to increase risk taking with respect to that company (Wright et al., 1996). Scholars also suggest that for the wealth concentration effect to be realized, it needs another condition, i.e., entrenchment. If insiders avoid growth-oriented risk taking, they may face the loss of their employment unless they are entrenched, for example, with a substantially high level of ownership (Demsetz, 1983; Gibbs, 1993). Together, these arguments suggest an inverted U-shaped relationship between insider ownership and risk-taking or firm value (Wright, Kroll, Krug, & Pettus, 2007). The findings of the present study imply that this inverted U-shaped relationship may occur when inside shareholders increase or decrease R&D investment in response to varied levels of growth opportunities. For example, insiders' concern over wealth concentration may slow down (expedite) the speed at which they increase (decrease) R&D in response to the presence (lack) of growth opportunities.

5.1. Limitations and future research

Care must of course be taken in generalizing any findings derived entirely from Korean companies. Family shareholders' behavior may vary depending on the context in which their decisions are made, such as the time period and the country (Peng, 2003). For example, family shareholders may have behaved differently before and after the Asian financial crisis in 1997/1998 because they may have faced different risks or have become more responsive to foreign and local capital suppliers after the crisis. Institutional changes can also alter the context in which decisions are made (Choi, Yoshikawa, Zahra, & Han, 2014). While the investigation of Korean companies offers a point of reference for future studies, emerging economies are particularly heterogeneous in their institutional, historical, and cultural backgrounds. Future research in different national contexts would give better insight into the influence of family owners and conditions such as business group membership. In addition, our findings may have implications for firms that are not family controlled but have multiple business divisions or segments. Such conglomerates tend to have a market value less than that of dominant single-segment firms (Rajan et al., 2000; Singh, Nejadmalayeri, & Mathur, 2007), though some studies (e.g., Villalonga, 2004) have shown a diversification premium. It is worth investigating whether or not U.S. conglomerates emulate Korean business groups in their R&D investment decisions in response to growth opportunities, and if their behavior is linked to their diversification discounts or premiums.

This study did not include firms in which the founder worked as a senior manager but no other family members were involved (Miller, Le Breton-Miller, Lester, & Cannella, 2007). Such lone founders are known to be more entrepreneurial and growth oriented than other types of family owners (Block, 2012; Miller, Le Breton-Miller, & Lester, 2011; Miller et al., 2007). One might thus conjecture that lone-founder firms may not show aversion to R&D investment and may be significantly different from other family firms in capturing industry growth opportunities through R&D investment. Future studies might fruitfully compare how lone-founder firms and other family firms differ in creating and exploiting technological opportunities.

Family owners may influence not only the intensity of R&D investment but also where those investments are made. For example, family owners may persuade affiliates to pursue projects that have greater overlaps with those of other affiliates to create synergy and wealth for the group as a whole. An analysis of the nature of R&D investments at the project level and of innovation outputs (e.g., patents) would further extend our understanding of how family ownership affects innovation by independent family firms and group affiliates.

The field may also benefit from investigating the specific control mechanisms that business groups use, such as a group headquarters, finance companies, and cash flow control (cf. Lu & Yao, 2006). Such mechanisms may elucidate how principal–principal conflict can lead to tunneling and propping. For example, Lu and Yao (2006) have observed that a finance company belonging to a business group takes responsibility for managing cash flows among the affiliated companies and allocates and redistributes funds for new projects or acquisitions. It may thus be easier for family shareholders to find ways to fund R&D projects in underperforming affiliates when the business group has a finance company. The finding that the family owners of business groups with more affiliates show more principal–principal conflict over R&D investments also indicates that business groups differ in terms of the

control mechanisms that they use, and that this heterogeneity may be closely related to the size of the group.

6. Conclusions

The influence of family ownership on R&D investment has been an emerging issue in family business and innovation research. This issue becomes even more complex with the realization that family owners may behave differently in different organizational forms. The analyses presented here indicate that the effect of family ownership on R&D investment may be not fixed but may change depending on the presence of growth opportunities and business group membership. This finding implies that family owners invest more in R&D when their family control goals are threatened by the loss of growth potential. The behavioral perspective helps to explain the complicated behavior of family owners with respect to R&D investment. We hope that these results will encourage future research on these complex but important issues.

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